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THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

DEVOTED TO THE ADVANCEMENT OF ASTRONOMY AND ALLIED SCIENCES

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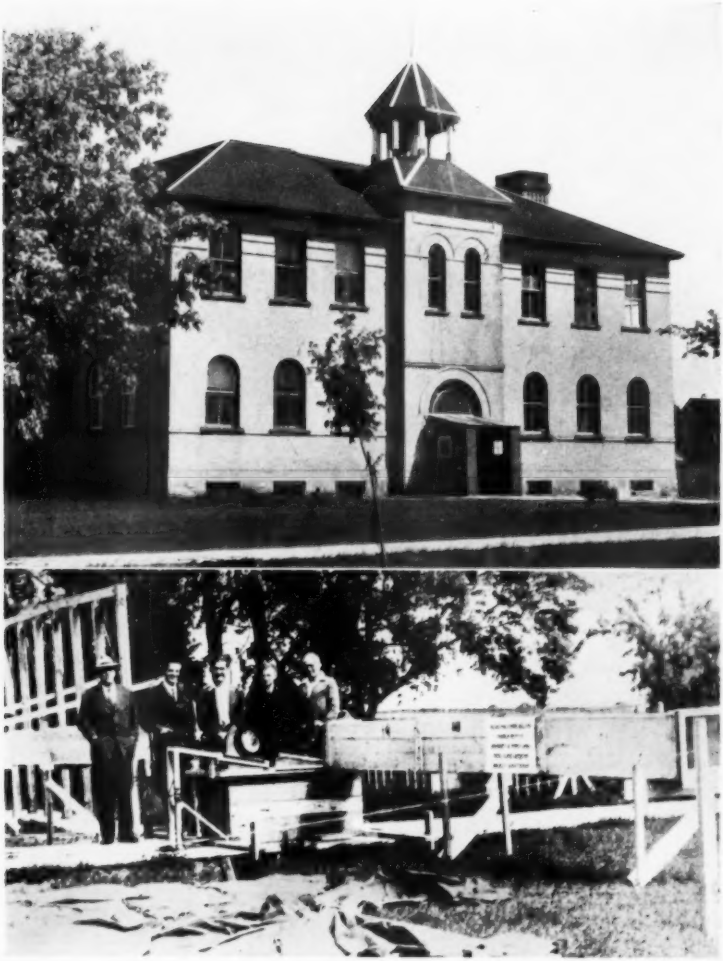
PLATE XI

TOTAL ECLIPSE OF JULY 9, 1945

Photographed at Wolseley, Sask., by Roy K. Marshall with a 6¼ inch lens of 18-foot focus. Exposure 30 sec.

Journal of the Royal Astronomical Society of Canada, 1945.



TOTAL ECLIPSE OF JULY 9, 1945

Above: The school house at Wolseley. The headquarters of the expedition was in the first-floor room to the right of the entrance.

Below: Left to right—Thomas Tiller, Town Clerk, Wolseley; Stanley Cole, Mayor, Wolseley; Roy K. Marshall; Orren C. Mohler; Richard M. Sutton.

40-foot camera, left; 18-foot camera, right.

Journal of the Royal Astronomical Society of Canada, 1945.

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VOL. XXXIX, NO. 7 SEPTEMBER 1945 WHOLE NO. 346

TOTAL ECLIPSE IN WOLSELEY, SASKATCHEWAN

BY ROY K. MARSHALL

Director of the Fels Planetarium, Philadelphia

(With plates XI, XII)

ON June 30, 1945, there appeared in the Philadelphia *Evening Bulletin* (afternoon paper of largest circulation in America) a piece by a popular and well-known staff writer, Don Rose. It was *Owed to the Solar Eclipse* and well bears reprinting:

> A solar eclipse is a comforting sight in a time of alarm and distress. It shows that the Sun and the Moon are all right, though this wicked old world is a mess. It proves that the planets are circling the sky exactly on time to the second, for where they will be on the ninth of July can be scientifically reckoned. The Sun and the Moon, on that definite date, will meet in the blue vault of heaven to start an eclipse, neither early nor late, at six or so minutes past seven.
>
> When catching a train on this uncertain Earth for travel to faraway sections, we study the schedules, for what they are worth, to figure out times and connections. And nobody knows and no one can say in these days of distraught transportation, what time of the night or what hour of the day we may reach our desired destination. But the Moon never swerves from its track in the sky and the Sun never stops on a siding to wait while a comet goes thundering by, or a couple of stars are colliding.
>
> So a solar eclipse is a comforting sight to see at six minutes past seven; it shows that the Sun and the Moon are all right, and running on schedule, thank heaven!
>
> To study the ways of the Sun and the Moon and the laws of celestial order, this city's astronomers go, very soon, beyond the Canadian border. They'll watch while a shadow blots out the bright Sun for thirty-five seconds, or nearly. I hope it is fine, or they won't have much fun, or see this phenomenon clearly. And what will they say as they patiently peer at

> a spectacle grand and sublime? They'll flash the glad news which the world waits to hear: "Hurrah! The eclipse is on time."
>
> For a solar eclipse is a comforting sight, serene and remote and impartial. Provided, of course, that it comes off all right. Please see that it does, Dr. Marshall.

The challenge was accepted! Indeed, it had been accepted a few weeks earlier, when the President of the Philadelphia Evening *Bulletin*, Mr. Robert McLean, who is also President of the Associated Press, accepted our invitation to defray the costs of the expedition that had been in process of planning for several months. Most of the instruments were borrowed from the Flower and Cook Observatories of the University of Pennsylvania, so the project bore the name of "The Philadelphia Bulletin—Franklin Institute—University of Pennsylvania Eclipse Expedition."

The planning of the expedition had been under way since October 1944, as far as the author is concerned. Over and over again the plans were revised, first in favour of a small, perhaps even one-man, expedition, then enlarged to a three-man project, as changes in conditions warranted. Late in April, the authorities of The Franklin Institute promised that at least a minimum expedition could be financed from Institute funds, but only two or three weeks later the guarantee came from the *Evening Bulletin* and an expedition numbering at least three men became a possibility. Dr. Richard M. Sutton, a member of the Committee on Science and the Arts, and Professor of physics at Haverford College, was anxious to go along; Dr. Orren C. Mohler, astronomer at the McMath-Hulbert Observatory (at Pontiac) of the University of Michigan, expressed a desire to associate himself with the group. These two, with the writer, constituted the scientific staff. Dr. C. P. Olivier, the Director of the Flower and Cook Observatories of the University of Michigan, declined in favour of the younger men, but showed his generosity and faith in the expedition by paving the way for the loan of approximately $5,000 worth of equipment belonging to the Observatories. Some additional equipment was provided by The Franklin Institute.

The program of observations was as follows: Direct photograph of the outer corona in visual light with an objective of 18-foot focal length; photographs of the inner corona in visual light with an objective of 40-foot focal length; photographs of the outer corona in red

and green light with fast cameras of 28-inch focal length; time-lapse motion pictures of the whole progress of the eclipse from first contact to fourth.

The motion picture camera, lent by the Eastman Kodak Company, was to be fed by a small coelostat provided by the Strawbridge Memorial Observatory of Haverford College; unfortunately, however, the camera failed to arrive in Philadelphia in time to accompany the remainder of the equipment, and arrived eventually in Regina only to be sent back to Philadelphia, after the eclipse.

The mounting of the twin 28-inch Ross lenses of 4-inch aperture was shipped by Railway Express, along with the coelostat of The Franklin Institute, designed to feed the 18-foot camera, and a tent, four cots and eight blankets lent by the Boy Scouts of America.

The rest of the equipment was carried along by plane. An important part of the arrangement with the Philadelphia *Evening Bulletin* involved furnishing photographs to the Associated Press; to expedite the delivery of these photographs, Harry Ferguson, expert Wirephoto operator, came to Regina from Chicago with his equipment to send the photographs by wire into the United States and throughout the entire Associated Press network. But in order to get the photographs into Regina it would be necessary to work fast. The best way would be to have a plane available at the eclipse camp. Mr. McLean of the *Evening Bulletin* furnished a fine two-motored Cessna plane, capable of carrying about 700 pounds of pay load. Dr. Mohler and the writer constituted a little less than half this load, while equipment made up the rest of it. Included in this were all the optical parts, including the mirrors of the coelostat and the heliostat to feed the 40-foot camera, the mounting and drive of the heliostat, the Haverford College coelostat for the motion pictures that never eventualized, the photographic plates and gelatin filters and developers and hypo, as well as many odds and ends of material that would prove useful in setting up the instruments.

Affiliated with the *Evening Bulletin* is radio station WPEN in Philadelphia and part of the program included a broadcast by direct wire to station WWDC in Washington and to station WPEN in Philadelphia. The radio remote control apparatus and microphones were carried along in the plane.

The town of Wolseley had been chosen as the place for the camp and preliminary correspondence with Thomas Tiller, the Town Clerk, had indicated that we should be welcome and that, if we found it suitable, the school would be put at our disposal. Providence had a hand in our selection of this site, for it was one of few places where clear weather prevailed on the morning of the eclipse.

The writer left Philadelphia in the plane, with the pilot Gene Geuther, at 2 p.m., July 4. About 5 p.m., a landing was made in Detroit, for the purpose of picking up Dr. Mohler, who was there with his wife and two daughters to see him off. An uneventful flight to La Crosse, Wisconsin, carried the three well on the way; the night was spent there. Early the following morning, the flight was resumed against strong head winds. A landing was made at Fargo, North Dakota, then another at Grand Forks, for the purpose of checking out of the U.S. Customs. There we were treated with the utmost courtesy and speed and started again on our way. At Winnipeg, Manitaba, we made formal entrance into Canada, again speeded on our way by the representative of the Canadian Customs, who enforced only the minimum formalities. One more hop took us to Regina, where we were greeted at the airport by Mr. Blake, Collector of Customs, who gave us permission to unload our equipment at any time.

But Mr. Blake had one item of bad news for us. The equipment shipped by express had not arrived, and we must start tracing it at once. We obtained hotel accommodation, the writer filed a report of the progress of the expedition, by Night Press Wire to Philadelphia, and the pilot and the two scientists went to bed. Early next morning, July 6, Mr. Blake came to the hotel with the news that the express shipment had entered Canada via Brandon, not Regina, and that it had been waiting for us at Wolseley for two days! The Customs authorities at Brandon had acted on their own responsibility and had sent the material on without delay. This was good news, indeed, and started the day off nicely for us. There were some matters to be attended to, however; the equipment must be taken to Wolseley, and a place must be found there to serve as a landing strip for the heavy plane.

We learned that governmental regulation forbade use of taxis be-

yond a 15-mile limit, but a visit to the Office of Wartime Prices and Trade Board in Regina cleared up this point. Mr. Mackie was very gracious not only in granting us special dispensation but also in persuading a taxi company to use some of its gasoline allotment for the job. We left Regina at about 12 o'clock, with the taxi loaded down with more than 300 pounds of equipment, two astronomers and Mr. Douglas Green, representative of the Canadian Press and the Associated Press. For 65 miles we drove eastward over the rich flat country of Saskatchewan, to the town of Wolseley on the Canadian Pacific Railroad, arriving at about 2.30 p.m., July 6. We paid our respects to Mr. Tiller, who was kind enough to take the pilot around the countryside in a vain search for a smooth level piece of sod suitable for a landing strip. It was finally agreed that the pilot should return to Regina and await any instructions we should have for him; it appeared quite definite, however, that the plane could not be brought out to Wolseley.

Mr. Tiller had arranged sleeping accommodation for the members of the expedition. Mr. Green and the writer were to share a bed in the Tiller home, while Dr. Mohler, Dr. Sutton, and others were to sleep in boarding houses and the small country hotel in the town. These matters being attended to, Dr. Mohler and the writer took the opportunity to inspect the school grounds as a possible site for the expedition. By this time it was raining, and as we stood in front of the yellow brick building of 8 rooms that provided the means of education to the young people of Wolseley, we saw in the east a magnificent rainbow, complete with primary, secondary and three or four supernumeraries. The writer took it as a bow of promise for success of the venture, although there were moments when the promise seemed to have been a shallow one.

The heavy equipment had been delivered at about 4 p.m., and the boxes were opened at once. Dr. Mohler decided to use one of the packing cases for a pier for the twin Ross cameras; the instrument was set up southeast of the school and a wedge made in Philadelphia was used to boost the altitude of the polar axis to the proper value, about 10 degrees higher than the value for Philadelphia. Electrical power was obtained from receptacles in the school, by way of long rubber-covered extension cords shipped for the purpose. In all of the

arrangements affecting the school, Frank Sharp, custodian, showed us every courtesy and gave every assistance. He and a number of volunteers among the residents who lived near-by helped with the unpacking and assembly of the equipment.

On Saturday, July 7, two carpenters and a helper were given the task of selecting the lumber and erecting the two wooden tubes for the long cameras. A large packing case was set on the concrete walk leading south of the school entrance and was firmly staked to the ground by means of substantial wooden planks stretching across the walk. This case served as the pier for carrying the coelostat to feed the 18-foot camera and the heliostat for feeding the 40-foot camera.

The square wooden tube for the 40-foot camera extended eastward from the pier on the walk; the 18-foot camera stretched westward from the pier. Telephone lines had been terminated near the school entrance for the radio equipment, which was to be set up near the pier on the walk.

By train, on Saturday evening, Dr. Sutton arrived from Philadelphia via Chicago, along with Mr. Harry G. Proctor, correspondent for the Philadelphia *Evening Bulletin*, Mr. Richard Shipp, radio control man from station WPEN, and Master Technical Sergeant George Steinhardt of the United States Marine Corps, a volunteer who came along to assist in the radio work and in any other capacity in which he might be needed.

Saturday had been an interesting day, with final arrangements beginning to fall into place. The morning had been clear; Dr. Mohler had been on the ground at 5 a.m. to watch the sunrise and to make sure that everything was all right as far as location was concerned. After sunrise, clouds came up and a magnificent solar halo was seen, presaging a spell of cold weather that persisted through eclipse day. The mornings were generally clear, early, but the afternoons were rainy. Sunday morning and Monday were clear and very cold. During the eclipse, the temperature was about 39 degrees; at the same moment, in Philadelphia, the temperature was above 70 degrees!

On Sunday morning, all three scientists were up with the Sun. Indeed, there was very little sleep for them; the writer spent Friday night in bed, lay down for an hour on Saturday night, and next went to bed after midnight on Monday! Dr. Mohler and Dr. Sutton did

a little better, getting in several hours of sleep on Sunday night. Sunday saw all of the construction work completed, and final tests of the instruments; the carpenters were very efficient and intelligent, especially Wilbur Willis and his helper, who did practically all of the work. Dr. Mohler and the writer had been watching a fine auroral display on Saturday night, and it is good that Mr. Willis knew exactly what was wanted of him, for there were periods of many hours when he had to work alone.

On Sunday morning there were brilliant sun-dogs, and by noon there was rain that continued intermittently through the afternoon. Mr. Mackenzie of the Canadian Press had come out from Regina to handle the telegraph dispatches, and he was very kind in his efforts to give us frequent and accurate weather reports. The situation looked rather bad throughout most of Sunday. During the afternoon, Mayor Stanley Cole held a party at his beautiful home for the members of the expedition and the many amateurs who had come from many points in the States and Canada to see the eclipse. The Associated Press had sent a wire asking that a picture of the camp and the personnel be sent by wirephoto that day, so in the middle of the party, and before refreshments were served, Town Clerk Tiller, Mayor Cole and the three scientists dashed to the school, with Mr. Green, who was to be the photographer. A picture was taken of the group, and all went back to the party save the writer, who remained to develop the film and arrange to get it into Regina by train. That chore accomplished, he was preparing to go to the little restaurant for supper, when the Mayor's car arrived to return him to a private party and, best of all, a hot bath in one of the few indoor installations in the town.

After supper, the scientists laid down the plan of attack. All instruments seemed to be in readiness for the work of the following morning. Dr. Sutton was to operate the twin Ross cameras, pulling slides and uncapping and recapping lenses for 30-second exposures. Dr. Mohler was to work at the lens end of the 40-foot camera, making at least two exposures—one of 3 seconds, the other of 10 seconds duration—while Douglas Green, the Canadian Press representative, was to pull slides and change plate-holders on this camera. The writer's job was to uncap and recap the lens of the 18-foot camera for

a 30-second exposure, and to make a 20-minute broadcast to Philadelphia, with the period of totality in the middle of it. A volunteer, Miss Janet Anderson of Detroit, was to operate the slide of the 18-foot camera. Mr. Shipp had his job already assigned, the operation of the radio control unit, while Sergeant Steinhardt would act as official timekeeper, using a Hamilton Chronometer Watch lent by the makers. At the writer's signal of "Go", Steinhardt would begin to watch time, calling out each 5 seconds from 5 through 25, then each single second thereafter. All slides were to be closed as soon as the lenses were capped at the count of "30" which would be considered the official ending of the eclipse. The calculated duration of totality was 34 seconds, but Baily's Beads might be expected to shorten this by 2 or 3 seconds.

The program having been outlined, last-minute arrangements were made, then Drs. Mohler and Sutton retired, the former at his room, the latter in the room that normally is devoted to instruction of Grades 1 and 2 in the Wolseley school. Miss Anderson, 15 years old but much interested in astronomy, was put to bed in the cloakroom of Grades 3 and 4, which room formed the headquarters of the expedition. Mr. Shipp and Sergeant Steinhardt were busy with three telephone officials, making sure that there was good through service to Philadelphia; the newspaper men, Green and Proctor, were busy writing their stories for the following day, insofar as it was possible to anticipate some of the events.

At about 11 o'clock, the weather prospects seemed dismal, and the pilot was called in Regina and warned that he might get a call that would require his taking off early in the morning in the effort to get above the clouds. Mayor Cole volunteered to drive the 65 miles into Regina, to take with him Dr. Mohler who, with a telephoto lens on a press camera, would photograph the corona from the plane, and Mr. Green, who would write the newsman's story of popular interest as he viewed the eclipse from above the clouds. The other members of the expedition would remain in Wolseley, hoping for clear weather. At 2.30 a.m., Mr. Mackenzie's report was very good, with clear weather at Moose Jaw, at Regina, and a west wind that would probably carry clear skies to Wolseley by morning. The writer took the

responsibility of deciding that the plane would not be used; all members of the party would remain in Wolseley.

Before dawn, clear skies were at hand, except for a thin low streak of cloud along the horizon from east through north to west. The Sun rose on a clear horizon, passed through the cloud streak, and rode well above it in a beautiful sky at totality. The weather conditions could not have been better at Wolseley, especially in view of the miserable clouds that prevailed at Bredenbury and at Roblin, farther along the path, where many expeditions were located.

Dr. Mohler came over at about 4.30 a.m., to load the plates. To him was delegated the responsibility of loading the plates and filters and developing the plates. Dr. Sutton was aroused in time to get well awake before time to go into action. Long before sunrise, visitors had begun to arrive; most of them were very well-behaved, however, standing well away from the instruments and hastening to step out of the way when one of the members of the expedition hurried from one place to another.

All instruments were given a last lining-up; the two long cameras were focussed visually and the coelostat and heliostat were started, to smooth out any kinks and irregularities of their motions. . The plates were put into the cameras well before the time of totality, approximately at 6.05, when the broadcast to Philadelphia and Washington began.

The school bell served to open the broadcast and for a little more than 10 minutes the scene and the events leading up to that moment were described. At 6.15, a "Ready" was given by Sergeant Steinhardt and all slides of cameras were pulled, although no lenses were uncapped. The next minute and a half seemed to roar past, at least as far as the writer's reaction is concerned. The crescent visibly thinned and shortened, with a flickering, smoky appearance that seemed at moments to obscure what was left of it. The shadow bands shimmered and slithered along the ground, at such a rate that, as Dr. Mohler said, "The seeing is very bad." The Baily's Beads clung after the corona sprang into view and then, at last, only the corona with the black Moon in the middle of it was shining out. The "Go" signal was shouted and all lenses were uncapped.

The writer had never before seen the corona. He had read des-

criptions by scientists and by popular writers and had looked at many photographs and paintings of the phenomenon. In other words, there was considerable preparation made for what was to be seen. But there is no description and no pictorial representation that begins to express the awe-inspiring beauty of the sight! The sheer delicacy of the stuff of the corona was startling; the decided three-dimensional effect was a complete surprise; the thinness of the texture in some portions and the sharp filaments or ribs in other portions were unexpected. Up to the right, at a distance of approximately one solar diameter, the corona came to a point; down to the left, the corona was blunt, but again about one solar diameter in extent, with sharp edges to the lamp-flame shape.

It was impossible to form any real mental picture of the corona in the brief time allowed. The broadcast was kept up, after a fashion, with little coherent description pouring into the microphone. Sergeant Steinhardt counted his time, five seconds at a jump, and it seemed only a moment before his "26, 27, 28, 29, 30", the last number yelled at the top of his voice, warned all that the eclipse was over. Lenses were capped, and slides were replaced. The eclipse lasted for another second or two, then a brilliant burst of light occurred at the western limb of the black Moon, then several other points flared forth, and a crescent began to lengthen. The calculated duration of 34 seconds was enjoyed, but the Baily's Beads intruded on it on both ends. The timing as determined from a transcription of the broadcast gives 33 seconds from the "Go" signal to the first burst of the Beads at the end.

While the author continued the broadcast, describing the way the shadow swept on across the earth after passing Wolseley, Dr. Mohler carried the plate made with the 18-foot camera into the dark room and developed it. The assembled villagers and other visitors remained to hear the broadcast; their tribute to the beauty of the corona was a good burst of applause at the reappearance of the Sun and throughout the remaining 8 minutes of radio time more than one of them was seen to be looking into the sky with a look of unbelief on his face. At the end of the broadcast, news men got their official statement and hurried away to file their stories.

The author hurried into the school, to find Dr. Mohler ready to

rinse the plate. The bright sky, in which only Venus and Mars could be seen by most observers, had produced a very dark plate; more serious, however, there were hundreds of pin holes in the emulsion. The corona was well shown, however, but the resemblance to the visual impression was small, in the author's opinion. No photograph could do the real corona even approximate justice!

The plate was rinsed beneath the pump in the basement of the school, then slipped, dripping wet, into the wooden frame that had been prepared for the purpose of carrying the wet plate into Regina. About 5 minutes remained before the departure of a train for Regina. The author yelled to Janet Anderson, "Let's go to Regina!" and the two jumped into the coupe of Mr. Willis, the carpenter. There was trouble in starting it, and it seemed that the train would leave without us, but at last, the station attained, it was found that the train was about 10 minutes late.

Miss Anderson and the author had barely slipped into a seat when the conductor arrived and asked, "Are you Dr. Marshall?" Pleading guilty, the author was greeted by a tall man who introduced himself as F. J. Fryer, superintendent of the Regina Division of the Canadian Pacific Railway. His private car, with a considerable party of family and friends, was on the end of the train, and the two messengers to Regina were invited to have breakfast and share the accommodations of the car into Regina. It was a pleasant ride, with good food and congenial conversation, although the fatigue of two sleepless nights began to impress itself upon the author, who dozed more than once, in the middle of sentences.

Upon arrival in the capital city, the author and Miss Anderson gave hasty thanks and farewells, and hurried to the offices of the Regina *Leader-Post,* whence the precious corona picture was to be sent by wirephoto into the network of the Associated Press. Prints of the picture were made in the newspaper's dark room, but transmission was not possible at once because there was a breakdown in the equipment at Minneapolis. At last, after considerable delay, the picture was routed via Seattle into New York! It was printed in many papers on the eastern coast that afternoon, and in hundreds of them over the rest of the country; still others carried it on the following morning. It is probably the fastest delivery of an eclipse photo

to a whole nation of newspaper readers; only mechanical and other unavoidable difficulties prevented even earlier appearance of the picture.

A transcription was made in the studios of station CKCK for later broadcast, then Miss Anderson and the writer returned to Wolseley by train, to be greeted by several townspeople and by Dr. Mohler. We went to the school and examined the other plates and found that nothing had been obtained with the 40-foot camera. Only one very black plate and one with no exposure were found in the plate holder. Probably this failure was due to faulty manipulation of the slides by the volunteer at the tail of the camera. The plates made with the twin Ross-Fecker cameras were very strong, and had considerable defects in them, but the results as later interpreted are very interesting.

Dr. Mohler, Dr. Sutton and Mr. Willis had pretty well cleaned things up, during the author's absence in Regina, and it was obvious that we could leave fairly early on the following day. We spent a pleasant evening at the home of the Town Clerk, Mr. Tiller, with Mayor and Mrs. Stanley Cole also present. Late in the evening, we went down to the train to bid good-bye to Mr. Shipp, Sergeant Steinhardt and Mr. Proctor, who were on their way back to Philadelphia. Back at Mr. Tiller's home, the author had his second hot bath in Wolseley, and slept in a real bed; it was a great treat after the strain of the preceding two days.

A call to Mr. Mackie in Regina next morning paved the way for another taxi to come out to pick us up, with our equipment. The lumber and hardware bills were paid, the heavy equipment was sent off by express, and our gratitude was expressed in poor words to a few of those who had made so pleasant our stay in Wolseley. We ate our last lunch in the little resturant, then set out for Regina. At about 4 p.m., we left the airport at Regina, on the way to Winnipeg. There we checked out of Canada; at Grand Forks, North Dakota, we performed the formalities necessary to re-enter the United States, then we flew on, stopping at Rochester, Minnesota, for gasoline, and flying on to Detroit arriving early the morning of July 11. There Dr. Mohler left us and the pilot and author flew on, to land at Harrisburg, then at Philadelphia, about two hours less than one week after

departure. Close to 4000 miles had been covered on the flight, for a sight of the corona for 34 seconds!

As usual, the coronal pictures show far more detail than can be reproduced, even on good photographic paper. A composite photo-sketch of the plate made with the 18-foot camera shows much structure in the intermediate corona, resolving itself essentially into the polar spikes or plumes and the equatorial jets or arches. On the basis of this one plate, the author concludes, and Dr. Mohler at least tentatively agrees, that the equatorial corona is made up of emission features, very largely. Almost all the structure is composed of arches and jets, strongly overlapped, with rather strongly marked regions of interruption at latitudes 60 degrees, north and south. There the equatorial features ceased and the polar spikes begin. The form of the corona is, overall, that commonly associated with a time of sun-spot minimum, without great extension in the plane of the Sun's equator.

The plates taken with the Ross-Fecker cameras show much greater equatorial extension and, what is more important, considerable difference between the images in green (effective wave-length 5300 A) and red (effective wave-length about 6500 A). There appears on both plates a large, approximately circular area, probably the so-called "globular" corona first emphasized at the 1937 eclipse. This is almost certainly due to sunlight scattered by particles of the corona, as are also the other featureless portions of the total corona. The author can not get away from the notion, however, that all the detailed portions of the corona, even including the very long equatorial extensions to distances of at least 2,000,000 miles at the eclipse of July 9, 1945, must be due to emission. The distribution of light can not be due to actual distribution of material; it may be the precipitation of material in some kind of a force-field but this would be another way of saying that the strange solar field is active at tremendous distances from the solar limb.

About twelve years ago, the author prepared for publication in this JOURNAL translations of Lyot's work. Now that he has had a chance to see the corona and to study photographs of it, he can say that there is much yet to be done at eclipses; indeed, if he could hope to avoid being considered impudent, he would say that there is practically everything yet to be done at eclipses. Is it the emission

corona that stretched out to distances of about 10,000,000 miles at the eclipse of 1878? This is certainly the "outer corona" and most writers state very plainly that the outer corona is composed of reflected and scattered sunlight. Many exposures with fast cameras, with several different narrow filter-emulsion combinations, should be made of the next long eclipse. Perhaps even a very efficient objective-prism camera might serve to separate the red and green images.

The writer hopes to obtain for comparison with the plate made with the 18-foot camera some comparable plate made by a Soviet expedition. Both plates will be made to yield isophotes; perhaps sufficient differences will be revealed to permit some definite statement to be made about the source of the coronal light in the intermediate and outer streamers. If much change is shown, it will certainly not be motion of actual matter, but instead a change of the force-field or other exciting medium. A slow and careful study of plates taken at earlier eclipses should be undertaken by a single investigator, or pair of them, so some of the conflicting statements can be reconciled. The writer hopes to undertake this, in time to formulate a plan of attack for the next two long eclipses—May 20, 1947, in South America (about 4 minutes) and June 20, 1955, in the Philippines (more than 7 minutes).

To all of those associated with me in this expedition, I wish to express my personal thanks for the utmost co-operation and consideration. To Dr. Olivier, for his courage in permitting me to borrow the equipment of his observatories, special thanks are due; to the officials of The Franklin Institute, my thanks are expressed for permitting me to spend much time in the preparations for the expedition, sometimes at the expense of more immediate matters. To the publisher, Robert McLean, and the many editors and writers of the Philadelphia *Evening Bulletin,* no adequate thanks are possible; without their financial assistance and the careful treatment they gave the expedition in the columns of that fine newspaper, the expedition would not have been a success.

The Franklin Institute
August 13, 1945.

THE TOTAL ECLIPSE OF THE SUN, JULY 9, 1945

A NUMBER of brief reports of observations made during the eclipse by amateur astronomers at various places in Canada have been received by the JOURNAL and are printed below.

Following them is a report of the Solar Division of the A.A.V.S.O.

Editor

OBSERVATIONS OF THE ECLIPSE OF JULY 9, 1945, AT QUEBEC, AT THE OBSERVATORY OF THE QUEBEC CENTRE

By PAUL H. NADEAU

Our work during the solar eclipse of July 9, 1945, consisted in an attempt to determine the times of the two contacts with more accuracy than by visual observation through the telescope. For this we worked out a cinematographic method, i.e., the taking of many pictures of the sun during short intervals, when the moon is entering on the solar disk and when leaving it. Furnishing a permanent record on material easily handled, this method is capable of considerable accuracy, provided that every picture is correctly timed and that the doubtfulness of the registered contact does not extend to many images. Our experience showed that this method is far more accurate than the visual one.

Through the courtesy of the Service de Ciné-photographie de la Province, we were able to use for the purpose a 16-mm. Eastman Ciné-Kodak Special. This camera was mounted behind the eye-piece of the finder of the 110-mm. refractor, thus giving on the film an image of the sun 3 mm. in diameter. The 110-mm. telescope was used to keep the image of the sun on the centre of the film. An absorbing screen, cutting out more than 95% of the sun-light was placed before the objective of the finder (33 mm. in diameter) and a yellow filter KK Medium was used before the lens of the camera open at f:1.9. With the shutter closed at ¾ and the number of pictures taken in a second being supposed to be 8, this combination gives an exposure of 1/60th of a second. It was our intention to use a synchronous motor to keep the frequency at 8 pictures a second but it could not be had in time. The usual spring driver showed much variation of speed.

The film obtained is of good quality, but when seen under a magnifying lens or a low-power microscope the search for the critical image is rendered difficult by the grain (the only film obtainable was the Super XX Panchromatic) and by the turbulence of the atmosphere which caused the "hollowing" to disappear during one image or more, especially when it was getting smaller.

The first image of the contact was estimated the 705th, with a possible error of ± 5 image. Furthermore, the exact time control showed that the camera registered 1,173 images during 125 seconds, in the first procedure, and 1,079 images during 117 seconds in the last one, which establishes its constant at 9.30 ±

0.08 pictures registered in a second. This error accumulated during the 125 seconds of the process, becomes ± 10 pictures. The total error expressed in pictures is therefore ± 15 pictures, which is the error of the method as realized in this occasion, and it corresponds to ± 2 seconds.

The calculation indicates that the 705th picture was taken at 7 h. 13 m. 38 s., which is considered the time registered at Quebec for the first contact. A group of observers, working with refractors 3 and 4 inches in diameter, estimated this first contact at 7 h. 13 m. 52 s., that is 14 seconds later. For the last contact, the pictures are not as good as the others, and we must make use of figures less favourable to the method. They indicate that this contact was registered only 5 seconds before the time given by the observers, i.e., at 9 h. 19 m. 5 s.

Thus the cinematographic method undoubtedly shows an improvement on the visual one. By obtaining a larger image of the sun, using a fine grain emulsion and a synchronous device to drive the film and studying the film with the unaided eye, it could become a very precise one, the possible error being reduced to that resulting from the turbulence of the atmosphere.

This work was under the direction of Mr. Paul H. Nadeau, assisted by Mr. Lionel Gallichan, as timekeeper, and by Mr. Charles A. Giroux. Mr. Paul Carpentier, of the Service de Ciné-photographie, was in charge of the camera.

Quebec, August 10, 1945.

OBSERVATIONS AT WINNIPEGOSIS, MAN.

By G. P. Morse

(See Plate XIII)

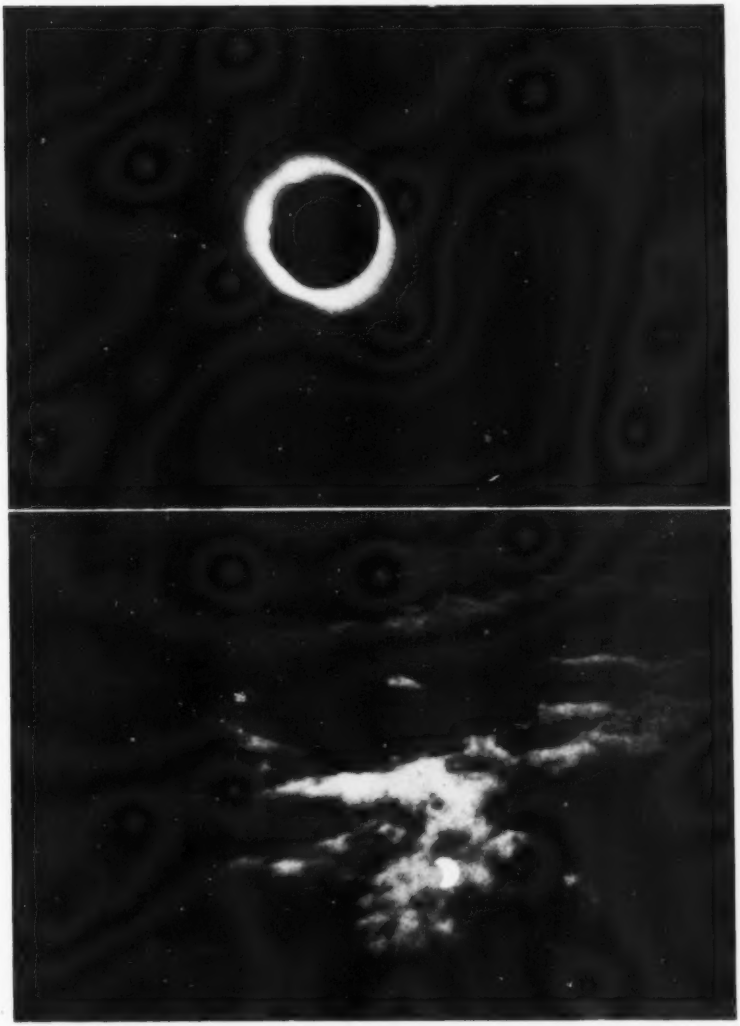
This town is some 25 miles east of Pine River Sta., and was near the edge of the path of totality.

I enclose a photograph (Plate XIII) which was the only worth-while result of my trip (other than visually). The clouds cleared about 7.10 a.m., C.D.T., and the photograph was taken at 7.18½ as nearly as could be estimated. Baily's Beads previous to totality were observed; and the "diamond ring" effect immediately afterward was excellent. There were some half-dozen other people on the beach at the time. For a few seconds I had the benefit of a "transit" with a blue-green attachment at the eye-end. The others were using smoked glasses.

The photograph has been enlarged about 7 diameters, having been taken on a "post-card" film; exposure 1/10 sec., verichrome, and wide shutter-opening. No filter.

It will be observed that the corona, though not widespread, appears so brilliant near one pole as to seem to "flatten" the moon. At one of the more expanded parts of the corona the *suppression* of radiation gives a somewhat squarish effect, which I noticed in news-photos, though not completely identical (either in time or form).

PLATE XIII



TOTAL ECLIPSE OF JULY 9, 1945

Above: Photograph by G. P. Morse taken at Winnipegosis, Man., 7.18½ a.m. (C.D.T.), exposure 1/10 sec.

Below: Partial phase, enlarged from portion of a 35 mm. negative, about ¼-inch square. Taken by P. S. Ridings, The Pas, Manitoba.

Journal of the Royal Astronomical Society of Canada, 1945.

There was a slight defect in the film, appearing like a crack in the moon (region of the Appennines?) and I thought it better to paint that out.

I may say that I advised a Miss A. Busch of Shellmouth, Man., that the conditions for totality would be very similar there; and though clouds interfered with her actual observation, her report reads that it was so dark (for a few seconds) that it seems evident totality occurred there also.

339 Dubuc St.,
Norwood, Winnipeg, Man.

PARTIAL ECLIPSE OF THE SUN, JULY 9, 1945, OBSERVED AT MONTREAL

By A. V. Madge

Observer - - - -	A. V. Madge.	*Timekeeper:* Mrs. A. V. Madge.
Location - - - -	Montreal, Que.	Latitude: 45° 28′ 58″ N.
	5175 Cote St. Luc Road.	Longitude: 73° 37′ 18″ W.
Instrument - - -	2¾″ astronomical telescope; equatorial refractor, portable.	
Methods - - - -	Solar cap for direct vision; projection on screen.	
Watch - - - - -	Elgin Railroad. Timed with U.S. Bureau of Standards Time Signals.	
First contact - -	(Viewed through eyepiece) Power 50 magnifications.	
	7 h. 11 m. 27 s.	Eastern Daylight Saving Time by watch
Add	21.5	Watch slow by time signals
	7 h. 11 m. 48.5 s.	Corrected time of first contact

Notes:—Immediately prior to first contact, approximately two seconds, greyish mark apparent at approximately 330° from the vertex. At contact, segment of greyish circle clearly visible on solar disc, lasting for almost one second after contact, then fading out. (May have been caused by a defect in objective or ocular but took a note to remind looking for similar phenomenon at last contact.)

Middle —Estimate middle of eclipse occurring at appriximately 8.10 a.m., E.D.S.T. Approximately 67% of solar disc (that is 67% of diameter of solar disc) covered.

Notes —At first sight the surface of the moon appeared to be quite black. After looking for some minutes it was apparent that the lunar surface was not altogether black but seemed to be covered with a faint, almost imperceptible, rusty tint with faint reddish highlights; no lunar configurations being visible. (May have been caused by dust on objective or ocular.) This slight coloration was noticeable during most of the remainder of the eclipse. Also seen by Mrs. Madge.

Two small sunspots near limb of the sun eclipsed as follows: (projection)

Spot No. 1. Contact with edge of sunspot penumbra at 8 h. 10 m. 11 s.

Spot No. 2. Contact with edge of sunspot penumbra at 8 h. 10 m. 33 s.

Re-appearance (projection)

Spot No. 1. This spot re-appeared at 9 h. 9 m. 6 s.

Spot No. 2. This spot re-appeared at 9 h. 10 m. 32 s.

Two other spots near the limb of the sun were not eclipsed.

Before the eclipse I noticed that the sunspots visible appeared quite dark. When compared with the darkness of the moon, however, they looked much lighter. Just before they were contacted by the limb of the moon they appeared to assume a dark orange hue. The same phenomenon was noted when the sunspots reappeared.

Perceptible dimming of daylight at middle of eclipse. Birds slightly nervous —a number viewed flying to nearby trees twittering. No noticeable radio interference, no static.

Segment of greyish circle again viewed at edge of lunar disc just prior to last contact and immediately thereafter. Somewhat like an "after shadow". seen through eye-piece. (Dust, or instrumental defect?).

Last Contact —Not timed exactly, interested in above mentioned greyish after shadow. Counting seconds backwards would give last contact as occurring at approximately 9 h. 14 m. 38 s. to 9 h. 14 m. 48 s., allowing maximum error of 10 seconds. Last contact point at approximately 115° from vertex.

NOTE ON THE ECLIPSE OF JULY 9, 1945

By W. H. Stilwell

The eclipse was observed at Rice Lake at Lat. 60° 02′ 13.0″ N. and Long. 103° 05′ 28.4″ W. At this point the obscuration was about 90%.

The beginning of the eclipse was lost in broken alto cumulus clouds. Glimpses of the progress of the moon's disc across the sun were obtained at intervals until shortly before maximum obscuration at which time the clouds had almost completely dissipated. The estimated time of maximum obscuration was 12 h. 31 m. G.M.T. The final contact was observed with a surveyor's theodolite and was timed as accurately as possible with a chronometer and a stop watch and occurred at 13 h. 29 m. 57 s. G.M.T. Very approximate values of the altitude and azimuth of the sun were recorded for the time of last contact and are, altitude, 23° 17′; azimuth, 86° 11′.

The astronomical latitude and longitude of the observer are known within 200 feet and if a more accurate value is desired, to within approximately 50 feet, it will be available when all the observations for this station have been reduced.

The R.C.A.F. personnel at Brocket Base, Lat. 58° 03.1′ N., Long. 101° 36.6′ W., observed the beginning and end of the eclipse at 11 h. 34 m. G.M.T.

and 13 h. 28 m. G.M.T., respectively. Their observations were made with the unaided eye since they had no instruments at their disposal. Sgt. R. Butler made the Brocket Base data available.

Geodetic Service of Canada,
Ottawa, July 9, 1945.

MAGNETIC OBSERVATIONS NEAR TIMMINS, ONT.

Under direction of W. JONES
Director of Geological Department, Hollinger Consolidated Gold Mines

Vertical Magnetic Intensity recorded at Kam Kotia Mine, Robb Township. During Eclipse, July 9, 1945. Lat. 48° 35′ 24″ N.; Long. 81° 36′ 42″ W. approximate.

Weather: 6.02 a.m. to 6.40 a.m., overcast; from 6.40 a.m., heavy rain.

Instrument: Askania, Schmidt Type Magnetometer. Magnet system temperature compensated.

Recorded by R. Davidson, Hollinger Exploration Co.

AVERAGE OF TWO READINGS 180° APART. EXPRESSED IN GAMMAS. TIME, a.m.

Time	*Gamma*	*Time*	*Gamma*	*Time*	*Gamma*
6.02	1186	7.19	1184	8.25	1202
6.04	1183	7.21	1184	8.30	1200
6.05	1184	7.23	1188	8.33	1200
6.09	1185	7.25	1188	8.36	1202
6.11	1187	7.27	1184	8.39	1200
6.13	1183	7.29	1184	8.42	1200
6.15	1188	7.31	1184	8.45	1198
6.18	1186	7.35	1188	8.49	1198
6.20	1182	7.37	1189	8.53	1196
6.23	1182	7.39	1189	8.57	1196
6.26	1184	7.42	1191	9.01	1196
6.30	1182	7.45	1193	9.04	1193
6.33	1186	7.47	1195	9.08	1196
6.37	1186	7.49	1195	9.13	1195
6.40	1184	7.52	1193	9.18	1195
6.59	1184	7.55	1195	9.22	1189
7.02	1181	7.59	1195	9.25	1189
7.04	1188	8.02	1205	9.29	1189
7.05	1186	8.05	1203	9.32	1189
7.07	1184	8.09	1207	9.37	1195
7.09	1184	8.11	1205	9.42	1202
7.11	1184	8.13	1202	9.47	1203
7.13	1186	8.16	1203	9.53	1198
7.15	1184	8.19	1202	10.16	1198
7.17	1186	8.22	1203		

THE ECLIPSE AT PORT MAITLAND, YARMOUTH, NOVA SCOTIA

(Portion of a letter from G. Radcliffe Parry, Commander R.N.R. ret'd to DeLisle Garneau, Montreal)

I feel quite sure of my times as I have a very good watch which I checked by radio time signals from New York both before and after the eclipse. Rather to my dismay, however, the first contact was observed 12 seconds later than the time I had calculated, whilst final contact appeared to occur 13½ seconds earlier than I had computed. The facts that these "errors" are almost equal and in opposite directions would appear to me to indicate a uniform lack of power or definition in my telescope at both observations; it would seem to discount any "constant" error in my calculations. Perhaps you or someone else at the Centre would be kind enough to give me advice upon this after checking my work.

I am enclosing my original computation, the results of which agree very well with those of other calculations by means of "navigational" formulae without use of Besselian Elements. I did not make a second calculation as probably results would not differ very materially, and did not calculate "middle of eclipse" as I had no means of checking by observation. Both contacts appeared to occur accurately at the points forecast, viz., my "V's" seemed right, which I suppose constitutes a rough check on my work.

I searched diligently for sunspots during the eclipse but observed none; near the middle of eclipse there appeared to be a slight "luminosity" round the upper horn of the sun's disc and at final contact I fancied the moon's limb was slightly illuminated as it broke away but these may have been illusions or due to defects in the lenses of my telescope.

JUNE, 1945, REPORT OF SOLAR DIVISION OF A.A.V.S.O.

By D. W. Rosebrugh

On page 172 of the May-June, 1945, Journal it was stated that in October, 1944, the American Association of Variable Star Observers had formed a Solar Division under the Chairmanship of Mr. Neal J. Heines, 560 Broadway, Paterson, New Jersey.

On June 17, 1945, the A.A.V.S.O. held a Council Meeting at Yale Observatory by invitation of Dr. Dirk Brouwer, Director. Mr. Heines submitted his first report and this indicated so much interest in observing the sun among amateurs and so much scientific value to the program that further information on the Solar Division's program may be of value to readers of this Journal.

So important is this work to the Carnegie Institution and the war effort, that Mr. Heines carries with him in his car, wherever he goes, his sunspot observing equipment. By special arrangement he even takes time out from his regular war work at an airplane factory to observe sunspots. At the time of his noon observation on June 17 he demonstrated his equipment to the A.A.V.S.O. Council members. His 3-inch portable Mogey refractor is mounted on a tripod with an equatorial-type head, with slow motion in R.A. but without circles or finder. Finding is done by centering the transmitted image of the sun on one's hand. Mr. Heines uses a Herschel prism, a one-inch positive eye-piece, and a neutral-tinted dark glass. In the field of view are cross wires which can be rotated so as to align one with the axis of the sun. The other will therefore lie more or less along the sun's equator. These cross wires furnish reference lines by which the location of a sunspot group on the sun's disc can be readily determined. Mr. Heines also has a micrometer screw and scale to aid him in estimating the size of sunspot groups, but neither this nor the equatorial-type head seem to be essential for the ordinary routine observer of sunspots like the writer.

In addition to Mr. Heines the members of the Solar Division Committee are the Rev. and Mrs. W. M. Kearons, West Bridgewater, Mass.; Mr. H. Helm Clayton, Canton, Massachusetts; Mr. H. B. Rumrill, Berwyn, Pennsylvania; and Dr. Donald H. Menzel, Harvard Observatory, Cambridge, Massachusetts.

M. DeLisle Garneau of Montreal is one of thirty-two members who are sending in monthly reports regularly. Twenty-two other observers are making plans to undertake the work. As of June 1, 1945, one hundred and twenty-five monthly reports had been returned to Mr. Heines and had been forwarded by him to the Carnegie Institution. The approximate number of observations involved in these reports was 2,036.

The Carnegie Institution of Washington, D.C., has analyzed these observations and has reduced them to a Preliminary Relative Sun-spot Number. The final Number must come from Dr. Brunner at Zurich. The preliminary numbers are as follows: December, 1944, 28.4; January, 1945, 20.3; February, 11.9; March, 18.5; April, 29.5; May, 26.5 (estimated).

In his report Mr. Heines thanked Dr. F. S. Hogg, Assistant Editor of this JOURNAL, and the editors of five other astronomical magazines for voluntary notices regarding the work of the Solar Division.

Twenty-four amateur astronomers were admitted to membership by the A.A.V.S.O. Council, many of whom have joined because of their interest in the Solar Division program.

The Nominating Committee, consisting of Mr. Donald L. Kimball, New Haven, Dr. Alice S. Farnsworth, Mount Holyoke College, and Mr. C. B. Carpenter, Wayne, Michigan, nominated a slate of six A.A.V.S.O. members to stand for election to the four vacancies which will occur on the A.A.V.S.O. Council in October, 1945, among the six nominated were M. Paul-H. Nadeau, M.Sc., Quebec, Quebec, and Mr. Neal J. Heines, Paterson, New Jersey.

87 Fern Circle,
Waterbury 69,
Connecticut.

THE MEANING OF SCIENCE

An Editorial in *Endeavour* for October, 1944*

THE century in which we live has witnessed an advance in man's command of the material universe unexampled in the previous history of the world. Indeed, it has been asserted by an eminent sociologist that the progress of the last forty years equals, and perhaps surpasses, that of the whole period of human history from the dawn of civilization up to the year 1900. The nations of the world now have at their disposal unparalleled power over natural substances and forces—a power which has been placed in their hands by the expansion of scientific knowledge, and which may be used for good or for evil purposes. Whether man has reached a stage in his moral evolution at which he can be trusted to turn these gifts to predominantly beneficial ends is a matter with which we are not for the moment concerned.

Concurrently with these advances in applied science has come a reformulation of fundamental theories. This has altered our concepts of that world-model which is sometimes naïvely taken to express the ultimate reality of things, and altered them in a manner that can only be described as revolutionary. It has also fostered a tendency to ask the questions, "What are the objects and scope of a scientific theory?"

Our nineteenth-century forbears had a simple answer to the first of these queries. Science to them was just "organized common sense," and inasmuch as their very successful physical theories were an extrapolation of large-scale mechanical notions to cover atomic phenomena the answer may be deemed to have been adequate at that time. But in these days of quantum mechanics and probability-smears the answer to the same question is not expressible with similar simplicity. What, then, are the aims and objects of the man of science in his quest for truth—or what he regards as truth? The reply to this second query may be found to include that to the first.

We have our being in a jungle of sense-impressions. The stars

*The Editor is E. J. Holmyard, M.A., M.Sc., Imperial Chemical Industries, Nobel House, Buckingham Gate, London, S.W.1.

wheel in majestic circles around the pole; the planets move with apparent irregularity amid the so-called fixed stars; the tides ebb and flow; the barometer rises and falls; April showers pierce to the root of the drought of March; figs do not grow on thistles; a respectable law-abiding citizen suffers a brain injury and becomes an irresponsible criminal: these are but a scattered few from thousands of facts which meet us on our journey through life, and which, our minds being what they are, demand a coherent explanation. It is the object of science to give that explanation; though whereas our ancestors were wont to attempt to answer the question "Why?" the man of science is today content if he can describe the "How?" of the particular phenomenon in which his interest lies.

Newton, indeed, has the root of this matter in him. His famous *Hypotheses non fingo* must be read in its context if we would grasp its true significance: "But hitherto I have not been able to discover the cause of those properties of gravity from phaenomena, and I frame no hypotheses; for whatever is not deduced from the phaenomena is to be called an hypothesis; and hypotheses, whether metaphysical or physical, whether of occult qualities or mechanical, have no place in experimental philosophy. In this philosophy particular propositions are inferred from the phaenomena, and afterwards rendered general by induction."

Restricting ourselves to the consideration of the physical sciences let us for a moment review the implications of a scientific theory. The great structure of nineteenth-century physics was based on Newtonian mechanics, which gave clear and precise definitions of such concepts as mass, force, momentum, energy, and the like. The laws of dynamics based on these concepts sufficed to describe with almost incredible accuracy an extraordinarily wide range of phenomena, from the motions of the planets down to the behaviour of the balls on a billiards table.

The scheme was extended into a conceptual submicroscopic world of atoms, and served to describe certain large-scale phenomena and to predict others, again with an accuracy that may be restrainedly designated as marvellous. The pressure of a gas, for example, was interpreted and calculated in terms of the movements of its molecular constituents; and whereas common observation shows that the viscosity of a liquid decreases rapidly with rise of temper-

ature, the kinetic theory of the billiards ball atom predicted an increase of viscosity in a gas as the temperature rises—a prediction that was later confirmed by experiment. Such instances might be multiplied almost indefinitely, and it is small wonder that the rank and file of nineteenth-century scientists—and indeed some of the leaders—were convinced that their atoms were as real as the benches and Bunsen burners in the laboratories.

So with the ether of space. Lord Kelvin said with characteristic vigour: "This thing we call the luminiferous ether . . . is the only substance we are confident of in dynamics. One thing we are sure of, and that is the reality and substantiality of the luminiferous ether." But alas! for such optimism. We are not so convinced today of the reality and substantiality of a luminiferous ether as was Kelvin. Even our concept of the atom has become complicated almost out of recognition and bears no resemblance to the perfectly elastic, spherical atom of the Newtonian epoch.

In truth, a scientific theory is concerned with phenomena rather than with any "reality" that may be supposed to lie behind them; its object, as Kirchhoff put it, is to describe, in the simplest possible fashion, the happenings in the physical world around us. If we can by means of a scientific theory correlate known facts and predict new ones the theory will have done for us all that a theory can do or is expected to do. Scientific theories have no permanance. They change with each generation and with a wider knowledge of perceptual facts; but—and it is a "but" that the lay mind too frequently fails to appreciate—each new theory subsumes the one it displaces, in the sense that it is merely a closer description of the same phenomena or a wider generalization embracing a greater number of phenomena.

It cannot be denied that, in the middle years of the nineteenth century, there was a phase of scientific materialism which for some time had a considerable vogue. England and Germany were the countries most affected; but even they were not entirely swept by the movement, and wiser judgments were soon uttered by leading scientists. The privates in the scientific army may have been given an ingenuous realism, but the staff in general held clearer views concerning the limitations of a scientific theory.

Science, then, is concerned with phenomena, that is, with appear-

ances. Working on this principle it has effected conquest of a large part of the material environment within reach, and shows every prospect of conquering much more. Whether pursuance of the same principle may lead to a knowledge of "reality" is a question to which the answer is not yet even dimly perceptible. As Sir James Jeans has more than once emphasized, science in its present stage of development can be compared, for all its marvellous accomplishments, to the babe's first nebulous awareness of its surroundings. It may know many more pebbles than Newton, but it still knows little of the beach, and less of the ocean.

"Reality," if it is to be discussed at all, must for the present be discussed as a philosophical problem, and the scientist as scientist need not adventure into such regions. For him a theory is merely a conceptual model of perceptual facts; it is, in the wise words of Sir J. J. Thomson, a tool rather than a creed. That should be a matter of satisfaction, for when the scientist looks around him at the monument he has erected, he might be forgiven if, of much other speculative thought, he murmured the sentiment of Omar Khayyam:

> "Myself when young did eagerly frequent
> Doctor and Saint, and heard great Argument
> About it and about: but evermore
> Came out by the same Door where in I went."

HER MAJESTY'S MAGNETICAL AND METEOROLOGICAL OBSERVATORY, TORONTO

By A. D. Thiessen

(Continued from page 230, this volume)

On June 10, 1850, Lefroy asked for the dismissal of H. Jones, another member of the establishment.

Observatory, Toronto, 10th June, 1850.

Sir,

I have the honor to state that I am desirous of parting with my servant Gunner and Driver H. Jones, and to request that he may be directed to rejoin his company and replaced by another man. I have no military complaint to make of Gunner Jones, whose general character and conduct have always been good, since under my command, but as a servant he gives me frequent dissatisfaction, and appears himself to be desirous of returning to military duty. With regard to his successor I have only to state that the accomodation here being very limited, I should prefer a married man without family, and if possible one accustomed to a similar situation.

I have . . .

J. H. Lefroy . . .

Lieut. Col. Dalton,
Commanding Royal Artillery,
Kingston, C. W.

Toronto, 22nd June, 1850.

Sir,

With reference to the communication from the Head Quarter Office, dated 14th June, 1850, requiring from me a more explanatory statement of my reasons for parting with my present servant, Gunner and Driver Hugh Jones, I have the honor to state, that whereas he was formerly active, useful and obliging in household duties, he has for many months past, exhibited qualities the reverse of all these. His conduct and demeanour have become the subject of repeated complaint. He has assumed a tone of grievance on reproof and given me to understand that he wished to return to his duty. The particular occasion which decided me to be rid of him, was a complaint of his laziness and uselessness in carrying out some alterations about the premises during my absence from home. I think it just to state that he possesses many valuable qualities as a servant, being sober, trustworthy, and when he so pleases, active and useful. I believe he now regrets his conduct.

I have the honor to be . . .

J. H. Lefroy,
Capt. R. A.

Lieut. Col. Dalton,
Commanding Royal Artillery,
Kingston, C. W.

Toronto, C. W.
4th July, 1850.

Sir,

In reply to your letter of the 3rd Instant requiring to know on behalf of Lieut. Col. Dalton, why I did not send off my late servant, Gunner and Driver H. Jones in conformity to the District order, and to your letter dated June 24th, I have to state that neither the terms of that letter or of the order in question, led me to understand that it was expected that I should forward Gunner Jones to Kingston, before the arrival of his successor, that Gunner and Driver D. Fry did not arrive here until the morning of Saturday the 29th June, that the following Monday being muster day, I considered it proper to have Gunner and Driver H. Jones mustered with this detachment until July 2nd, on which day he was despatched to Kingston.

I have the honor to be

. . .

J. H. L.

Lieut. and Acting Adjt. H. F. Millar,
Kingston, C. W.

During this period of Captain Lefroy's administration the tragic story of Amy Cooper[84] was concluded.

Toronto, 22 December, 1848.

Sir,

I have the honor to report to you that Amy Cooper, widow of the late Gunner and Driver George Cooper, formerly of this Detachment, has been discharged from the Provincial Lunatic Asylum, of which she has been an inmate since July 1846. She represents herself to be entirely destitute, and without friends in the country. She is desirous to be allowed a passage to England by the first opportunity, having come out with her husband in 1842, and I have further the honor to make application on her own behalf for permission to draw rations during good behaviour, or until an opportunity offers for sending her home.

I have . . . J. H. Lefroy . . .

Lieut. Col. Dalton,
Kingston, C. W.

Corporal Lennon[85] had been brought into the observatory in July, 1846, to replace Bombardier William Grace, discharged for drunkenness. At that time Lennon appeared to be "a steady and intelligent young man, giving good promise for the future." However, in June, 1848, he was dismissed for drunkenness

Magnetical Observatory,
Toronto, 13 June, [1848]

Sir,

I have the honor to annex a statement of a crime recorded against Corporal James Lennon, No. 1 Company, 1st Battalion, being the second instance in which he has been guilty of a similar breach of discipline within a short period, and I am under the necessity of requesting that you will be pleased to direct this N.C. Officer to rejoin his company. I beg to state that the former act being his first offence, while under my command, was not recorded, as he was allowed after a short confinement to return to his duty.

I have the honor to request that he may be permitted to remain here, until the 1st July, when it is probable that the Services of a N.C. Officer in his place will be no longer required.

I have the honor to be,
Sir,
Your most obedient Servant,
Captain J. H. Lefroy

Lieut. Col. Dalton,
Commanding R. Artillery., etc., etc., C. W.

"Corporal P. Lemon, 1st Batt. confined by order of the Commanding Officer for being absent from roll call on the evening of the 11th June, 1848, and not returning until ½ p. 11 o'clock, afterwards quitting his barracks again, and not returning until 6 a.m. on the morning of the 12 June, 1848.

Magnetic Observatory,
Toronto, June 14, 1848.

Sir,

I regret to be under the necessity of again reporting Corporal Lennon, 1st Batt., to you for the annexed crime, and of requesting that you will be pleased to direct a Court Martial upon this N.C. Officer, whenever he shall be discharged from Hospital, where he is at present under treatment for an injury, received during his absence from duty.

I beg to state that pending my last reference to you I had released Corporal Lennon from confinement and directed him to return to his duty, not being prepared by the previous general good conduct of this N. C. Officer for such an immediate repetition of misconduct.

I have the Honor to be,
Sir,
Your most obedient Servant,
J. H. Lefroy,
Capt. R. Artillery.

Lieut. Col. Dalton,
Comdg R. Artillery, etc., etc., C. W.

Crime.

Toronto, 14 June, 1848.

Corporal James Lennon confined by order of the Commanding Officer for being absent from roll call on the evening of the 13th June, 1848 and not returning until brought back by an escort, at or about 1 p.m. on the 14th June, 1848, he being then drunk.

J. H. Lefroy, Captn.,
Royal Artillery.

Witness Serjt. James Johnston.

Observatory,
Toronto, 23rd June
1848

Sir,

In reply to your letter of the 20th June, I have the honor to state that the evidence I am prepared to produce against Corporal Lennon is as follows:

Charge, "Absence from roll call on the evening of the 13th June and not returning until brought back by an escort at about 1 p.m. on the following day being then drunk.

Witness: Serjt. James Johnston, who called the roll.

Gr. and Dr. I. Graham, escort.

Private W. Bennett, 2 Batt., R.B. Hospital Orderly.

I have the Honor to be,
Sir,
Your most obedient Servant,
J. H. Lefroy, Captain,
R. Artillery

Lt. and Adj. N. Mackay,
R. Artillery, etc., etc., etc.
C. W.

A copy of the Defaulter Book is requested and Corpl Lennon's Regimental Number. J. H. L.

Royal Artillery, Dist Office,
Kingston, C. W., 25 June, 1848.

Charge preferred against Corporal James Lennon of Capt Collington's Company, 1st Battalion Royal Regiment of Artillery.

"Absent from Tatoo Roll Call at the Magnetic Observatory, Toronto, on the evening of the 13th June and not returning until brought back by an escort at about one o'clock p.m. on the following day, he being then drunk."

Summary of evidence.

Serjt James Johnston of the Royal Artillery called the roll at the Magnetic Observatory on the evening of the 13th June, 1848, and found the Prisoner absent.

Gunner and Driver Joseph Graham of the Royal Artillery went on escort

in search of the Prisoner and found him about one o'clock p.m. on the 14th June, 1848, he was then drunk.

Private W. Bennett, 2nd Bn, Rifle Brigade
Hospital Orderly
Charles Dalton,
Lt. Col.
Commanding R. Artillery,
Canada West.

Having mentioned so much misconduct, it is pleasant to record also instances of excellent conduct.

Magnetic Observatory,
Toronto, Canada,
January 12, 1848.

Sir,

I beg leave to bring to your favorable notice the excellent conduct and long service of Sjt. James Walker, 7th Batt., second assistant in this observatory, as giving him a claim to any advantage in the form of a higher scale of extra pay, for which you may think proper to recommend him. Srjt Walker has performed the laborious and trying duties of an assistant at this Observatory with great intelligence and unremitting application, for the period of eight years. I can bear the highest testimony to his general character. I beg leave to add that the amount of work required from the N.C. Officers is such that its performance reflects much credit upon them. It is attended with peculiar restraint and confinement, and is trying both to the constitution and to the eyesight, grounds which I trust you will consider to justify me in referring to your consideration the propriety of some arrangement which shall entitle them to look for some increase of pay, for a lengthened service of such a nature.

I have the honor to be,
Sir,
Your most obedient Servant,
J. H. Lefroy

Lt. Col. Sabine, R.A.
Supt.—Observatories.

James Johnston was awarded a Good Conduct Medal on May 3rd, 1848. He was honourably discharged on August 4th, 1849.

Toronto, 3rd May, 1848.

Sir,

I have the honor to acknowledge the receipt of your letter of the 2nd inst. inclosing an extract from a General Order dated 31st March 1848, and a Good Conduct Medal, awarded by that General Order to Serjeant James Johnston, 7th Bn.

I have the honor to report to you that I have had the pleasure of delivering this mark of distinction to Serjeant Johnston, on Public Parade this day in the presence of the Detachment, and that I expressed to him at the same time the satisfaction which you have been pleased to express at being made the medium of this communication to him.

I have the honor to be,
Sir,
Your most obedient Servant,
J. H. Lefroy
R. Artillery

Lieut. Col. Dalton, Commanding R.A., etc., etc., etc.,
Kingston, C. W.

Observatory,
Toronto, 23 March, 1849

Sir,

Serjeant James Johnston, 7th Battalion, who has been Senior N.C. Officer of this Detachment, and Senior Assistant in the Observatory since its first establishment in 1839, is about to request his discharge from the Service. Serjeant Johnston has served 23 years, 15 of them abroad, namely 6 years in Bermuda, and 9 in Canada. He has never been confined. He has been 21 years a Non-Commissioned Officer, and is in possession of a Good Conduct Medal. Under such circumstances I feel it equally a duty and a pleasure to request that you will be pleased to take steps to bring forward the name of Serjeant Johnston as a claimant for the reward held out by Her Majesty's Warrant of 19th December, 1845, to N.C. Officers for Meritorious Services, and to support his application by the strongest recommendation in my power. Serjeant Johnston has been under my command with occasional intervals for a period exceeding six years, and I can say with confidence that his diligence, and exemplary conduct give him a claim which I cannot suppose to be easily surpassed for any reward provided by Her Majesty's bounty for deserving soldiers.

I have . . .
J. H. Lefroy . . .

Lieut. Col. Sabine . . . Woolwich . . .

Serjt. James Johnston, 7th Battalion 6th Company, aged 42 years, has been 23 years and 3 months in the service during which time he has been 6 3/12 years in Bermuda and 9 6/12 years in Canada.

Now complains of rheumatic pains in his back and loins which unfit him for stooping when working, or from night duty at the Observatory. He has not beeen in Hospital, as having had the above complaint for eight years (more or less) he was not considered a likely subject to be benefited by treatment. His general appearance is that of a man worn out by length of service, and as

his complaint has been greatly aggravated within the last year, I consider that he is totally unfit for further service.

(Signed) A. Anderson, M.D.,
Surgeon,
2nd Bn: Rifle Brigade.

Toronto, C. W.,
April 27th, 1849.

Observatory,
Toronto, 28 April, 1849

Sir,

I have the honor to inclose a medical certificate from the senior military surgeon at this station relating to the case of Serjeant James Johnston, 7th Bn. R.A., who has appeared before the Major General in Command of the District, for the purpose of being invalided, and to request that you will be pleased to take steps to submit the same to the Inspector General of Hospitals for his consideration and decision.

I have the honor to be,
Sir,
Your most obedient Servant,
J. H. Lefroy, Captain, RA.

Lt. Col. Dalton,
Commanding R.A.

Extract from Acct. Book of Serjeant J. Johnston, No6Co7BnRA

Enlisted: 25th Feb 1826 at Armagh Ireland.
Age: 19 years.
Parish: Mully break.
County: Armagh.
Trade: a weaver.
Services abroad: Bermuda 8th Dec. 1829 to 2nd March 1836; Canada 8th Nov. 1839 to present time; Remainder in England.
Promotion: Bombr. 1st Sept 1829; Corporal 18 April 1836; Serjeant 12 April 1843 and in possession of a good conduct medal;
Sjt. Johnston wishes to remain in Canada.

J. H. Lefroy, . . .

Magnetic Observatory,
Toronto, 4th August, 1849.

Sir,

I have the honor to request that you will forward an application to the Commanding Officer to sanction the employment of an assistant at this Observatory in the place of Serjeant Johnston, discharged this day, until instructions as to our future establishment are received from home. I am informed

by Lieut. Col. Sabine that although he has not yet received an official notification of the consent of the Lords of the Treasury to the Continuance of the Establishment, he has reason to believe that they have so decided, and he has in consequence recently dispatched additional instructions, etc., A reduction in the daily routine of the Observatory renders it practicable to carry on the duties with our present strength of the three Non-Commissioned Officers, but I am induced to request that Serjeant Johnston's place may be supplied, in consequence of the delay that will be occasioned by his loss, in the completion of a great amount of transcription, and calculation which is on hand. Should the Commanding Officer think fit to direct the appointment of a temporary assistant according to the present application, his receipt of working pay will depend upon the decision of the Treasury as to the Continuance of the Observatory, none having been paid since the expiration of the last authority on the 31st March ultimo, but I have no doubt myself, that he will receive it. I have to request that the man selected be intelligent, steady, and tolerably quick with figures. He must also write a pretty good hand.

I have the honor . . .
J. H. Lefroy . . .

Lieut. Col. Dalton,
Commanding Royal Artillery
etc., etc., etc., Kingston C.W.

Observatory,
Toronto, 4th August, 1849.

Sir,

I have the honor to report that the Certificate of Discharge of Serjeant J. Johnston has been handed to that N.C. Officer, and that he will receive pay with the Regiment, from and after this day. He has been paid to the 4th August inclusive.

I have . . .
J. H. Lefroy . . .

Lieut. Col. Dalton,
Commanding Royal Artillery,
Canada West.

On February 4th, 1850, Lefroy recommended Gunner and Driver James Liley for promotion.

Magnetic Observatory,
Toronto, Feby 4th, 1850.

Sir,

I have the honor to submit to your favorable notice the conduct of Gunner and Driver James Liley, 9th Battalion, who has now been employed as assistant at the Magnetic Observatory nearly five months, during which time his general steadiness and diligence have been perfectly satisfactory. Referring to your communication dated 31st January just received, I beg to state that I see no

reason to alter the opinion expressed in my letter of 26th November ultimo as to his genuine efficiency, but at the same time have pleasure in recommending to your notice his military good conduct and beg to submit his name for promotion to the rank of acting Non-Commissioned Officer.

I have the honor to be

. . .

J. H. Lefroy . . .

Drink seems to have been a mocker of discipline in the Observatory in the first years of its establishment, for in dismay, on October 9th, 1850, Lefroy, when looking for a new man to replace an old man discharged for "Drunkenness," exclaims: "I have seen the Corporal who informs me that he cannot recommend him or any other man of the Detachment for Sobriety."

Magnetic Observatory, Toronto,
Oct. 9th, 1850.

Sir,

With reference to my letter of yesterday the 8th instant, I have the honor to state, that Gunner and Driver Dewar, whose transfer to this detachment I therein requested is now under confinement for Drunkenness, and that Corporal McWilliams appears to have been misunderstood in what he informed my senior N.C. Officer, respecting the man's character. I have seen the Corporal who informs me that he cannot recommend him or any other man of the Detachment for Sobriety. I beg therefore to revoke my application and to request instead, that a suitable man be sent from Kingston. There is one small room available in which a married man without family may be accomodated. I should prefer however a steady single man. His duties will be such as to require great steadiness and activity. He will receive working pay.

I have . . .

J. H. Lefroy,
Capt. R.A.

Lieut. Col. Palmer,
Commanding R. A.,
Kingston, C.W.

On October 7th, 1850, the Observatory had its first military funeral.

Magnetic Observatory,
Toronto, October 6th, 1850.

Sir,

I have the honor to request that the necessary arrangements be made for the military interment of a late Gunner and Driver of the Royal Artillery belonging to the detachment who expired this morning.

I have to request that a firing party be detailed of the usual number for a

private soldier, and a carrying party of not less than 16 men, together with that portion of the band usually attending upon such occasions, the whole to be ready to march from the house of the deceased on Elizabeth Street to the Roman Catholic burying ground on the Kingston Road, at 2 p.m. tomorrow, Monday the 7th instant.

I have the honor to be

. . .

J. H. Lefroy . . .

Ensign Adjt. R. C. W. Stewart,
etc., etc., etc., Toronto.

Magnetic Observatory, Toronto,
October 8th, 1850.

Sir,

It is with very great regret that I have to communicate the death of Gunner and Driver Joseph Graham, late orderly man to this Detachment, an office which he had discharged with fidelity and invariable steadiness since the formation of this Establishment. The cause of his death which was unexpected by the Staff Surgeon who attended him, was returned as "Cholica." He had been ill only three days. He died early on Sunday morning and was interred yesterday, Monday, the 7th instant, with military honors. I have delayed this communication one post to make inquiry if a suitable man for his situation is to be found in the detachment of the Royal Artillery at the Fort, and find that Gunner and Driver Dewar of Capt Stace's Company, who is recommended by his N.C. Officer, is willing to accept it. I have the honor to request that he may be transferred accordingly. Not having access to a copy of the Finance Regulations, I beg to enquire whether any indulgence can be shewn to the Widow and Family by the temporary continuance of Rations, and to recommend them as in every way deserving to whatever indulgence is permitted. She is not desirous of returning to England.

Lt. Col. Palmer,
Comdg. Royal Artillery,
Kingston, C.W.

Two letters refer to the condition of the University grounds and the physical features of the campus, since considerably altered.

Magnetic Observatory,
Nov. 14, 1847.

Sir,

I beg leave to make a representation through you to the council of the University of an improper exercise of authority, as I conceive, by the person in charge of the avenue gate on Queen Street, in positively refusing to open it yesterday (Sunday) for one of the N.C. Officers who was returning in a cab with his family from the Christening of his infant. The mother was in consequence obliged to walk the distance of a mile, carrying her infant, which he has

represented, in my opinion with justice, as a hardship and cruelty. He reports to me that he has been refused entrance on other occasions.

I also beg to take this opportunity of representing to the council the inconvenience to which my friends and others who have occasion to visit the Observatory are constantly put by the practice of locking the upper gate. Upon one very urgent occasion it was the cause of considerable delay in the arrival of Dr. King, and might have been attended by most serious consequences. I understand the rule to be that the Yonge Street gate is always locked after 6 p.m. and the upper gate of the avenue is locked at the discretion of the Gate Keepers, consequently they may both be locked together, a practice which is inconsistent with the right of way reserved by the Board of Ordnance and places me under the necessity of making it a request to the council that orders may be given to discontinue locking one gate or the other. There are now four families residing at the Observatory, and it is most inconvenient that there should be any impediment to free access to it at all hours.

I have the honor to be,
Sir,
Your most obedient Servant,
J. H. Lefroy,
Capt. R.A.

Dr. Boys,
The University.

Observatory, 2nd April, 1848.

Sir,

The bridge over the creek near the Observatory having broken down, and standing in need of immediate repair, I beg leave to submit the case to the consideration of the Council of the University, which may be disposed, I conceive, to wish something of a more substantial and permanent nature done to it, than I feel authorized doing on my own responsibility. The bridge can be rendered passable by new planking the roadway, but it appears that the sides have given way, and the sleepers are so far decayed as to make it evident that they must be replaced in the course of two or three years. Under these circumstances I beg leave respectfully to suggest to the Council that it will be a fair and advantageous arrangement if the council will take this opportunity of renewing the sleepers, the supports, and the side sheathing, leaving me to plank the roadway afresh at the Public expense. I have consulted Mr. Wedd and inspected the Bridge with him, and he agrees with me in opinion that the share of expense which I propose to the council to bear will not exceed five pounds.

I have the honor to be,
Sir,
Your most obedient Servant,
J. H. Lefroy,
Captain, Royal Artillery.

Dr. Boys, Bursar, etc.

We have had occasion before to mention the money worries of the early directors of Her Majesty's Magnetic Observatory.

Toronto, 7th May, 1847.

Sir,

I have the honor to acknowledge the receipt of your letter of 1st May, 1847, inclosing a remark from the Surveyor General on account dated 31st March, 1843, and to state in reply that the amount of £1. 4. 0. is due to you from the Magnetic observatory as there specified, and will be paid to your order or transmitted to you by the first opportunity.

I have, etc.,
J. H. L.

I. H. Harvey, Esq.,
Ordnance Storekeeper,
Kingston.

Magnetic Observatory,
Toronto, 19th June, 1847.

Sir,

Having been informed by the D.O. Store Keeper at this Station that in the Ordnance Estimates for the expenses of the current year, recently received, no provision has been made for the continuance of this establishment, and having reason to believe this omission to have resulted from an oversight, I have the honor to request that you will submit to his Excellency, the Commander of the Forces, a statement of the circumstances with a request that he be pleased to grant a temporary authority to the Commissariat Department for the issue of all allowances, whether of rations or extra pay, on the account of the Magnetic Observatory, for which the special authority expired on the 31st March ultimo, until a reference can be made to the Board of Ordnance and Treasury. I have the honor to state that in January, 1843, the same circumstance occurred, and was represented by me to his Excellency the Commander of the Forces by Letter dated 11th February. The approval of his Excellency was signified by Letters dated 17th February, 1843, Nos. 5013 and 27th March, 5135. Also again in December, 1845, replied to dated 31st December, 1845, No. 9708.

I beg leave to add that independently of the circumstance that no intimation whatever has reached me of an intention to discontinue the establishment, or alter its footing, an evidence that none is entertained, is afforded by the fact that a non-commissioned officer left Woolwich on the 12th May in charge of Instruments to join the establishment, and is now on the way.

I have, etc.,
J. H. L.

[No address]

(*To be continued.*)

NOTES AND QUERIES

Communications are invited, especially from amateurs. The Editor will try to secure answers to queries.

Typographical Errors in the Article "Arcturus"

Our readers are asked to excuse any typographical errors which they may have noticed in the article "Arcturus" by M. J.-Edgar Guimont in the last issue (p. 217). Through a misunderstanding the galley proofs posted to the author did not reach him.

C. A. C.

Death of the Right Reverend T. W. Morton

The Winnipeg Centre has suffered a severe loss in the death of its Honorary President, who passed away on June 25, 1945.

He was widely known, in and out of Canada, as a highly cultured and lovable person; his wide knowledge on scientific subjects was freely shared with others less gifted; his kindly and tolerant disposition was appreciated by almost as many Protestants as Roman Catholics. He did a great deal to inspire a keen and lasting interest in the sciences of Physics, Chemistry, Astronomy and Astrophysics, having lectured for many years in these subjects in a competent and most interesting manner. His character was strong but was tempered with the utmost kindness and generosity and must have been a tremendous influence for good among countless numbers of people of many creeds; he will be hard to replace.

He was born at Boston, Lincolnshire, England, on September 15, 1862, and was educated at St. Edwards, Stonyhurst and Prior Park. After his ordination at Clifton in 1904, he held livings at Bristol and Wells until 1919, when he came to Winnipeg. In 1920 he founded Camp Morton, on the shore of Lake Winnipeg and this is a fine tribute and memorial to his valuable social work. In 1927 he was appointed Prothonotary Apostolic by Pope Pius XI. He retired from his clerical duties in 1935. He had attended few astronomical meetings during the last few years, but he came to a lecture by Dr. J. A. Pearce last year.

L. T. S. Norris-Elye,
President, Winnipeg Centre

A Political Star Chart of the Twelfth Century

With the above title an article by Professor W. Carl Rufus, of the University of Michigan, was printed in the February 1945 issue of the Journal. It has led to the following exchange of Communications between Professor Rufus and Dr. Herbert Chatley, of Bath, England.

Dr. Chatley to Professor Rufus (June 1945)

This interesting paper describes the text attached to the well known Soochow star chart and suggests that the names of the asterisms have a political basis.

The author appears to be under a misapprehension as to both the chart and the text. The matter of the text is to all intents and purposes the same as would have been written some 1500 years earlier and almost everything in it as to the heavens can be found in writings of the last centuries before Christ. Similarly the names of the asterisms are almost all known at this earlier period, so that what is said of them applies not in the twelfth century A.D. but at least as early as 150 B.C.

The author says "Effort has been made to identify not merely each asterism but also every star". As there are fragments of catalogues of stars back to before the time of Christ, with stated positions, there is nothing very strange in this.

As to political nomenclature it is probable that some of the asterisms were named after the political system of the Chou dynasty (about 1000 B.C. to 221 B.C.), since during that time a stellar religion developed and the Emperor was paired with Heaven, but there seems to have been an older system which applies to the majority of the asterisms. The suggestion that the minor stars are uncertain in the asterisms is correct but this arises from faulty mapping, ambiguous description and difficulty of seeing. There is no real reason to attach any other meaning to this uncertainy, which has no political bearing.

The astrology of the Chinese was almost entirely what is called "mundane", i.e., political. So also was that of the Mesopotamians and O. Neugebauer has made a very plausible case for astrology (in the prophetic sense) as being a peculiarly Babylonian invention.

I am at a loss to understand why the author regards this chart as "idealized", since there is no essential difference between it and the sketch maps in the "Star Classic" of the T'ang dynasty which is a recension of a Han or late Chou book.

Professor Rufus to Dr. Chatley (July 20, 1945)

Our mutual friend, Dr. Esson M. Gale, acted as "transmitter" of your comments on my paper, "A Political Star Chart of the Twelfth Century."

My brief article is based on a more extensive treatise now in press, "The

Soo Astronomical Chart" by Hsing-Chih Tien and W. Carl Rufus, which contains a new translation of the text, the first to be published in English, also a complete list of asterisms with translation and remarks, the first in any language, as far as known to the authors.

The writer is not "under a misapprehension as to both the chart and the text." We also anticipated that the introduction of the term *idealization* would meet with opposition by some sinologues. It is applied to designated asterisms on older star maps referred to by our critic and to others on the Soochow Chart, where changes were made to adapt the work "for the instruction of an emperor." Several illustrations are used to support the new idea of idealization, which was proposed to help in explaining discrepancies by former scholars and commentators.

Perseid Meteors Observed in Montreal.

Mr. A. V. Madge of 5175 Cote St. Luc Road. Montreal, sends the following report:

DeLisle Garneau, Jacques Labrecque, Jacques Desjardins and I went up to my roof Saturday evening to observe the Perseids. The accompanying table may be of interest:

NUMBER AND MAGNITUDE OF PERSEID METEORS OBSERVED IN MONTREAL AUGUST 11-12, 1945

Mag.	No.	Mag.	No.	Mag.	No.	Mag.	No
-6	3	-1	21	2.5	3	5	20
-5	3	0	17	3	102	5.5	1
-4	3	1	64	3.5	2	6	2
-3	6	1.5	1	4	59		
-2	18	2	80	4.5	2		

Altogether, this group recorded 407 meteors at the average rate of 83 per hour. Our record sheets and maps will be forwarded later on.

Certain of the meteors had all the usual characteristics of the Perseids, but they were bigger. This year we may run through a section of the orbital path where the meteoroids were more closely packed together. We enjoyed excellent visibility and observing conditions, the thermometers reading:

Time	Dry Bulb	Wet Bulb
Midnight	74°F.	68°F.
1.00 a.m.	72°F.	66°F.
2.30 a.m.	70°F.	64°F.
4.00 a.m.	68°F.	62°F.

I have been informed that a group observing with Mr. Morgan recorded 170 meteors during the same night, and that Mr. Guimont observed 185 meteors. He was alone.

Mr. Garneau and I agree that this was the best meteor display we have seen in Montreal. It was the best one I have seen at any time.

C. A. C.

MEETINGS OF THE SOCIETY

At Vancouver

January 23, 1945.—This was the first meeting of the year and the speaker was Dr. J. A. Pearce, Director of the Dominion Astrophysical Observatory. Dr. Pearce presented his retiring address as honorary president of the Vancouver Centre of the Society, and chose as his subject, "The Pleiades Cluster."

The speaker gave an interesting account of the mythology associated with this most interesting star cluster, and also a summary of recent researches on its members. The stars in the cluster are difficult objects for which to determine radial velocities, since the spectral lines are broad and difficult to measure accurately. The lecturer, however, has carried through an extensive radial velocity program for this cluster, and greatly increased our knowledge of stellar motions in this group. Whether or not a star belongs to a cluster, is determined by a study of its radial velocity and proper motion relative to other stars definitely in the cluster. Members of a cluster show common motion towards a given point in the sky. Dr. Pearce's study has added many stars to the known number in the Pleiades cluster.

The lecturer discussed the past and future of the cluster. Any star cluster is subject to the disrupting force of the galactic nucleus, and also random encounters with passing stars. The length of time that a cluster will hold together depends upon its density. The Pleiades cluster has a high enough density to enable it to hold together for a period of around 2×10^{10} years.

At the close of the lecture there were a number of questions concerning stellar motions.

WILLIAM PETRIE, *Recorder.*

February 14, 1945.—The regular meeting of the Society was held in the Science Building at the University. The speaker of the evening was Mr. T. W. Hall of Trans-Canada Airlines, and his subject, "Electronics in Aviation."

The speaker pointed out that the "safety factor" in aviation has been improved constantly by the increasing use of electronic devices. The various regions of the electromagnetic spectrum were explained, and Mr. Hall discussed the frequencies used in navigation. The lecturer next explained the mechanism of transfer of radio waves between two points on the earth's surface. Actually, two different waves travel from source to receiver. The "ground wave" follows directly the curvature of the earth, while a second wave is reflected from the ionosphere and received at a certain distance from the source. The critical frequency that is reflected from the ionosphere shows diurnal and seasonal variations, and much more work is necessary to determine quantitative data regarding the ionosphere. The middle and high frequency ranges are most useful

for communication since they obey ordinary optical laws and their range can be easily computed.

Mr. Hall showed the mechanism of radio beam control. Four towers send out radio signals of two different types. Along a line equidistant from towers sending out opposite types of signal, the plane's pilot hears a steady hum over the receiving set. If the plane is off this line, the signal has varying intensity, and from these intensity variations, the pilot can determine his position with reference to the towers. The audience was shown how a landing is made at a Vancouver airport using the radio beam.

Mr. Hall explained the action of various navigational devices. The loop antenna is a simple device which uses the principle of electromagnetic induction. When the loop presents the greatest area to the direction of the sending station, the signal received is a maximum. The speaker closed with a short discussion of a completely blind landing system.

WILLIAM PETRIE, *Recorder.*

March 13, 1945.—The speaker at this meeting was Mr. Norman Barton of the Physics Department, University of British Columbia. His subject was "Photography Applied to Astronomy."

The speaker first discussed the early attempts at photographing celestial objects. In 1845, a photograph of the sun showed the presence of sun spots. In 1849, the first successful plates of the moon showed the main surface features well known to visual observers. The first solar eclipse was photographed in 1860, and the prominences were definitely shown to be associated with the sun. With the introduction of the dry plate, celestial photography went ahead rapidly both with respect to quantity and quality.

Mr. Barton showed a number of slides comparing the early and modern photographs. These showed the remarkable improvements which have been brought about in a few years. The speaker briefly discussed the aberrations which reduce the efficiency of reflecting and refracting telescopes. These faults can be eliminated to a high degree in the Schmidt telescope. Mr. Barton showed slides of the larger Schmidt telescopes now in use.

The lecturer closed with a short discussion of infra-red photography. Infra-red plates have been improved of recent years and are now fast enough for practical use in astronomy. The speaker suggested that the future of astronomy lies in an improvement of photographic techniques rather than in building large telescopes.

WILLIAM PETRIE, *Recorder.*

April 10, 1945.—The speaker at this meeting was Dr. William Petrie of the Physics Department of the University of British Columbia. The title of the lecture was "An Illustrated Discussion of Astronomical Spectra."

The lecturer gave a short historical account of the problem of stellar

classification. Secchi and Huggins divided stellar spectra into four groups as follows:

(1) Blue stars with few lines in their spectra.
(2) Yellow stars with many lines in their spectra.
(3) and (4) Red stars whose spectra contain bands as well as lines.

With the introduction of the photographic process into astronomical research, the collection of stellar spectra increased rapidly, and the inadequacies of Secchi's classification soon became apparent. Professor Pickering, the third Director of the Harvard Observatory, organized an extensive program to classify objective grating spectra. The major part of the work was carried out by Miss Annie J. Cannon, and the results published in 1924 in the Henry Draper Catalogue. Miss Cannon divided stellar spectra into six main types which contain 99 per cent of all known stars. Later, four additional types were added to her original classification.

The problem of accounting for differences in stellar spectra is an interesting one. It now appears that these differences are almost completely explained by a temperature scale. The red stars are at low enough temperatures to permit the presence of some molecules, and these produce the bands which are characteristic of later type spectra. The early type stars are at higher temperatures and atomic lines only appear in their spectra. Quantitatively, the changes in stellar spectra are explained by two equations. The Boltzmann equation gives the relative numbers of atoms in any two energy levels as a function of temperature. The Saha ionization equation gives the relative numbers of ionized and neutral atoms as a function of temperature and pressure in the stellar atmosphere. Using these equations, one can predict the changing appearance of stellar spectra.

At the close of the lecture there was some discussion of atomic theory and the future of astrophysics.

WILLIAM PETRIE, *Recorder.*

At Edmonton

January 11, 1945.—The president called the meeting to order at 8.18 p.m. A guest from the Montreal Centre, Flight-Sergeant Donnelly, was introduced to the meeting, and welcomed.

The set of constellation maps donated to us by No. 4 I.T.S. was shown, and volunteers were called to give five-minute constellation talks at the beginning of the programs of the regular meeting. Dr. Campbell gave the HANDBOOK talk.

The main paper of the evening, on the Spectroscope, was given by Mr. Sheldon Gibson, a student graduating in Honours Physics.

In astronomy, the spectroscope is a very valuable auxiliary to the telescope. Its appreciation depends on an understanding of the wave-nature of light, where the transfer of energy can be roughly compared to waves on the surface of water. These waves suffer reflection at polished opaque surfaces, and refraction at polished transparent surfaces, according to definite known laws. Both

these processes involve deviation of the ray from its original direction. A net deviation results when light passes through a block of glass with non-parallel sides, such as a prism or a lens. In such cases colours appear if white light is incident, and the resulting coloured band is called a spectrum. A spectroscope is an assemblage of lenses and prisms, with perhaps a photographic plate, designed to give a clear image of the spectrum from any source of light. Continuous spectra come from incandescent solids and liquids, bright-line spectra come from properly excited gases and vapours, absorption spectra are produced when cool material must be traversed by the light on its way from the incandescent source to the spectroscope. (Examples of all these types were shown to the audience in the Physics Laboratory at the close of the meeting.)

The change in pitch of a sound when the observer is in motion toward or away from the source is called the Doppler effect. The spectroscope makes it possible to observe a similar effect in light, and to measure relative velocity in the line of sight. By this means the details of solar rotation have been studied, and the nature of Saturn's rings verified through direct observation. In some cases the line-of-sight velocity of stars and nebulae can be measured, and much information about the structure of the universe has been collected.

After a short period of discussion and questions, the meeting adjourned to the Physics Laboratory, and then to Room 111 for refreshments as usual. There were 30 members and visitors present.

E. H. GOWAN, *Hon. Sec.*

February 8, 1945.—The meeting was called to order at 8.17 p.m. Dr. Campbell pointed out Dr. Revell's note on strange atmospheric phenomena in England. This was also referred to in *Nature*, the September and December issues, 1944.

The HANDBOOK talk was taken by Mr. Wates. He read his fourth humorous poem, *To a Professor of Astronomy.*

The main paper, on Star Temperatures, was given by Dr. R. J. Lang of the University Department of Physics. There is an important relation between the amount of light given out by a star and its temperature. Double the temperature will produce 16 times the light. Techniques of temperature measurement were described. Total radiation and the Stefan-Boltzman Law make use of the thermopile and the size of a star. This gives 5700 degrees absolute for the sun. Another method uses the spectrum, the energy associated with different wave-lengths being measured. The theory giving the shift of the maximum with wave-length leads to a temperature of 5,000 degrees absolute for the sun, but there is a different shape of curve for the centre, the average, and the edge of the sun.

There are errors in all these measurements due to the absorption of energy by water vapour, carbon dioxide, and ozone in the atmosphere. When these are corrected by calculating what would be received outside the earth's atmosphere, then by finding the area under the radiation curve the figure 5713

degrees absolute results for the sun. These are all surface temperatures. The interiors of stars are much hotter, estimates running up to 20 million degrees.

The apparent brightness of a star depends on its temperature, size, and distance. If we know the distance we can calculate its effect. Reducing all the stars to what they would be at a standard distance, gives the absolute magnitude. Stars have been classified on the basis of this, their spectra, and their temperatures. The so-called Russell diagram summarizes this classification.

E. H. GOWAN, *Hon. Sec.*

March 15, 1945.—The President called the meeting to order at 8.18 p.m. Dr. Johns read a note from Headquarters suggesting we ask for extra gasoline to make possible an eclipse expedition from Alberta.

It was moved by Mr. Keeping, seconded by Miss Malanchuk, that the Centre have a standing Observatory Committee of three members; and that the President, Honorary President, and Mr. Wates be appointed.

The usual HANDBOOK talk was given by Mr. Wates. Mr. Deane moved, seconded by Mr. Stockwell, that the poems recently read by Mr. Wates be mimeographed and made available to members of the Centre.—Carried.

The main paper of the evening, The Life and Work of Sir Arthur Eddington, was given by Professor E. S. Keeping. Sir Arthur Eddington was to have been the first of the new Honorary Members of the Royal Astronomical Society of Canada, but died last November before he could accept. Hence it is fitting that his work should be commemorated in Canada.

The speaker pointed out that he had to rely for biographical details mainly on two or three obituary notices in *Nature* and elsewhere.

After a very brilliant academic career, Eddington commenced work as a practical astronomer at Greenwich, and at the age of 31 became Plumian Professor of Astronomy at Cambridge where he continued for 30 years. Besides a long series of research papers he published several standard textbooks on stellar motions, the Theory of Relativity, Constitution of the Stars, etc., and a number of more popular and philosophical works, such as *Stars and Atoms, New Pathways in Science,* and the *Philosophy of Physical Science,* which enjoyed great success.

A summary was given of Eddington's great contributions to astronomy, to the unification of relativity theory and quantum theory, and to general cosmology. His most recent work, claiming deduction of physical results from the pure theory of knowledge, was briefly discussed. Scientific opinion as to the ultimate value of this work has not yet crystallized.

Extracts exemplified Eddington's charming style of writing, and also his firm and continuing belief in the quiet personal religion of the Quakers. He was keenly interested in many forms of sport, and was himself a good swimmer. His death at the height of his powers is a great loss to the astronomical world, as well as to our own Society.

During the discussion Professor Stansfield revived personal memories of his days at Dalton Hall in Manchester with Eddington. Dr. Campbell told of meetings and discussion with Eddington in Edmonton and Ithaca.

E. H. GOWAN, *Hon. Sec.*

April 12, 1945.—The president called the meeting to order at 8.25 p.m. The audience stood for a minute in silence as a tribute to President Roosevelt.

Mr. P. J. Kiernan, 9862—76 Ave., Edmonton, was elected a member of the Society.

Mr. O. W. Colley, of Castor, was accepted with pleasure as a life member.

The HANDBOOK talk was given by Dr. Campbell. An article had appeared in *Popular Astronomy* about Easter Intervals. Part of the amusing introduction was read.

The main paper of the evening was given by Mr. S. G. Deane on the subject Planetary Atmospheres.

The various methods by which observational data are collected were described. Direct visual observation with telescopes of various powers shows surface markings and changes. Photography by ultra-violet and infra-red light shows effects of the smaller and greater penetration into a planet's atmosphere. Study of the polarization of the light reflected by the surfaces gives some information about the nature of these surfaces. With thermocouples the actual surface temperatures can be found. Spectroscopic analysis reveals the chemical composition of the atmospheres. Along with all these the general theory of matter (based on laboratory experiments) is used as a guiding thread.

Each planet was then considered in turn, the evidence regarding its atmosphere summarized, and the possibility of life existing in some form or other was discussed.

E. H. GOWAN, *Hon. Sec.*

May 10, 1945.—The President called the meeting to order at 8.25 p.m.

A letter was read from the general secretary to the regional oil controller regarding our possible application for extra gasoline to make an eclipse expedition. It was agreed that any interested members should get in touch with the executive. Some details of accommodation in towns along the path of totality were given, including a letter from the town clerk at Wolseley.

The following were elected members of the Society:

Mrs. Clarkson, Lawton, Alberta.
Mr. H. J. Pallot, 10918—79 Ave., Edmonton.

Dr. Campbell gave the HANDBOOK talk. This is the best time of the year for observing the moon if the nights are clear.

The main paper was given by Dr. H. E. Johns, of the Physics Department, his subject being the solar eclipse of July 1945. The speaker illustrated the general principles of solar eclipses by diagrams and a model. He explained the

variations in relative distance of the sun, moon, and earth, and the effect of these variations on the size of the shadow and on the duration of totality. The effect of the line of nodes, and its rotation of 20 degrees per year was described.

There are and have been various reasons for observing eclipses. At one time there was much interest in searching for an extra planet between Mercury and the sun. Accurate eclipse timing gives a check on the calculated relative positions of the earth, sun, and moon. The nature of the sun as shown by prominences, eruptions, and the corona can now be studied without waiting for an eclipse, but this is only recently possible. Even now the visual beauty of these displays can only be seen during total eclipse. The gravitational effect of the sun on a ray of light, predicted by the theory of relativity, can be tested during a total eclipse. The effects on radio propagation have helped elucidate the cause of the ionized layer in the upper atmosphere. Other artistic effects which occur when the crescent is very small are the moving shadows, and Bailey's beads.

E. H. Gowan, *Hon. Sec.*

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1890-1945

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For many years the Toronto organization existed alone, but now the Society is national in extent, having active Centres in Montreal and Quebec, P.Q.; Ottawa, Toronto, Hamilton, London and Windsor, Ontario; Winnipeg, Man.; Edmonton, Alta.; Vancouver and Victoria, B.C. As well as about 950 members of these Canadian Centres, there are over 200 members not attached to any Centre, mostly resident in other nations, while some 300 additional institutions or persons are on the regular mailing list for our publications.

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